California Environmental Protection Agency

Air Resources Board

PERMEATION RATES OF
HIGH - DENSITY POLYETHYLENE
FUEL TANKS
(May 2001)

Engineering and Certification Branch
Monitoring and Laboratory Division

June 11, 2001

PERMEATION RATES OF HIGH - DENSITY POLYETHYLENE FUEL TANKS (May 2001)

Introduction

The California Air Resources Board (CARB) staff tested 21 High-Density Polyethylene (HDPE) fuel tanks to determine their permeation rates. Tanks were preconditioned with commercial fuel with MTBE or ethanol oxygenates, refilled with Phase II California Reformulated Certification (CERT) fuel or commercial fuel containing ethanol, and subjected to a variable temperature profile. Permeation rates were then determined gravimetrically during the month of May.

Test Protocol

In March and April, the tanks underwent the preconditioning process. Tanks used with 4-cycle engines were preconditioned with commercial fuel or commercial fuel containing ethanol, per CARB Test Method 513. Tanks used with 2-cycle engines underwent the preconditioning process using a 2% commercial fuel/oil mixture. The tanks were stored at ambient temperature and pressure in flameproof storage cabinets. After at least four weeks of ambient preconditioning, the tanks were emptied; dried with compressed zero air, and immediately refilled with either CERT fuel, commercial fuel containing ethanol, or a 2% fuel mixture. The tanks were then sealed using a hand held fusion welder and 1/4" thick HDPE coupons and leak tested as specified in Test Method 513 (a copy can be found at the CARB web site: http://www.arb.ca.gov/regact/spillcon/spillcon.htm).

Weight loss was used to determine relative permeation rates. Sealed tanks were weighed using a 16,000 gram or 6,200 gram balances with sensitivities of ±0.1 and ± 0.01 grams respectively**.** After each tank was weighed, the weight was recorded. They were then placed in the Sealed Housing for Evaporative Determination (SHED) and exposed to a 1-day/24-hour/1440-minute variable temperature profile (see Attachment 1). This profile is considered our diurnal cycle (recurring every day). Tanks were then post weighed after each 24-hour diurnal cycle and the weight loss calculated.

Results

Cumulative weight losses were determined for each container as a function of time. The tanks underwent multiple diurnal cycles, but results are calculated using only the last five 24 hour cycles. Typically, the initial days of test data were not used in determining individual per container permeation rates due to variability. A summary of all test results can be found in Attachment 2.

The average permeation rate for the 1.4 gallon Murray tractor tank (40508X92) designated T4FE was determined to be 0.00 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 1.7 fluorinated Snapper tractor tank (M301019BE) designated T5FE was determined to be 0.01 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 3.9 gallon Toro tractor tank (72045) designated T6E was determined to be 0.87 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 5 gallon fluorinated Coleman generator tank designated T11F was determined to be 0.00 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.50 gallon Toro mower tank (20040) designated T19 was determined to be 2.97 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.50 gallon Toro mower tank (20040) designated T19E was determined to be 3.31 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.38 gallon Lawn Boy mower tank (10363) designated T20 was determined to be 3.25 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.25 gallon Briggs & Stratton tank (695106) designated T24C was determined to be 5.88 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.25 gallon Briggs & Stratton tank (695106) designated T24D was determined to be 5.71 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.25 gallon Tecumseh tank (35586) designated T29 was determined to be 3.38 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.25 gallon Tecumseh tank (35586) designated T30 was determined to be 2.74 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.25 gallon Tecumseh tank (35586) designated T31 was determined to be 2.94 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.25 gallon Tecumseh tank (35586) designated T32 was determined to be 3.43 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.07 gallon 2-cycle Frigidare Home Products tank (530-0038592) designated T37 was determined to be 5.11 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. A 2% mixture of oil and commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.09 gallon 2-cycle Frigidare Home Products tank (530-049318) designated T38 was determined to be 3.92 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. A 2% mixture of oil and commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.06 gallon 2-cycle Frigidare Home Products tank (530-052243) designated T39 was determined to be 5.57 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. A 2% mixture of oil and commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.25 gallon Yard Machine mower tank (11A-021C000) designated T40E was determined to be 3.80 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.25 gallon Yard Machine mower tank (12A-559K401) designated T41E was determined to be 4.28 grams/gallon/day. This

rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing ethanol was used for testing.

The average permeation rate for the 0.25 gallon Craftsman mower tank (917379440) designated T42 was determined to be 5.22 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.38 gallon Craftsman mower tank (917389580) designated T43 was determined to be 2.47 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

The average permeation rate for the 0.25 gallon Yard Machine mower tank (11A-414D729) designated T44 was determined to be 4.25 grams/gallon/day. This rate is based on data averaged from tests of five 24-hour diurnal cycles. Commercial fuel containing MTBE was used for testing.

Attachment 1

1 Day / 24 Hour / 1440 Minute Variable Temperature Profile

HOUR	MINUTE	TIME REMAINING (MINUTES)	TEMPERATURE (°F)
0	0	1440	65.0
1	60	1380	66.6
2	120	1320	72.6
3	180	1260	80.3
4	240	1200	86.1
5	300	1140	90.6
6	360	1080	94.6
7	420	1020	98.1
8	480	960	101.2
9	540	900	103.4
10	600	840	104.9
11	660	780	105.0
12	720	720	104.2
13	780	660	101.1
14	840	600	95.3
15	900	540	88.8
16	960	480	84.4
17	1020	420	80.8
18	1080	360	77.8
19	1140	300	75.3
20	1200	240	72.0
21	1260	180	70.0
22	1320	120	68.2
23	1380	60	66.5
24	1440	0	65.0

Attachment 2

PERMEATION TEST RESULTS

May 2001

Diurnal Cycles (# 24 hr cycles)	Tank Label	Mfg.	Tank Volume	Treatment Level	Test Dates	Fuel Type	Avg. Loss (g/gal/day)
5	T4FE	Murray	1.4 gal	Fluorinated	4/30 - 5/9	Ethanol	0.00
5	T5FE	Snapper	1.7 gal	Fluorinated	4/30 - 5/9	Ethanol	0.01
5	T6E	Toro	3.9 gal	Untreated	4/30 - 5/9	Ethanol	0.87
5	T11F	Coleman	5 gal	Fluorinated	5/1 - 5/9	Pump	0.00
5	T19	Toro	0.5 gal	Untreated	4/30 - 5/9	Pump	2.97
5	T19E	Toro	0.5 gal	Untreated	4/30 - 5/9	Ethanol	3.31
5	T20	Lawn Boy	0.38 gal	Untreated	4/30 - 5/9	Pump	3.25
5	T24C	Briggs	0.25 gal	Untreated	4/30 - 5/9	Ethanol	5.88
5	T24D	Briggs	0.25 gal	Untreated	4/30 - 5/9	Ethanol	5.71
5	T29	Tecumseh	0.25 gal	Untreated	4/30 - 5/9	Pump	3.38
5	T30	Tecumseh	0.25 gal	Untreated	4/30 - 5/9	Pump	2.74
5	T31	Tecumseh	0.25 gal	Untreated	4/30 - 5/9	Ethanol	2.94
5	T32	Tecumseh	0.25 gal	Untreated	4/30 - 5/9	Ethanol	3.43
5	T37	FHP	0.07 gal	Untreated	4/30 - 5/10	Ethanol Mix	5.11
5	T38	FHP	0.09 gal	Untreated	4/30 - 5/11	Ethanol Mix	3.92
5	T39	FHP	0.06 gal	Untreated	4/30 - 5/9	Ethanol Mix	5.57
5	T40E	Yard Machine	0.25 gal	Untreated	4/30 - 5/9	Ethanol	3.80
5	T41E	Yard Machine	0.25 gal	Untreated	4/30 - 5/9	Ethanol	4.28
5	T42	Craftsman	0.25 gal	Untreated	4/30 - 5/9	Pump	5.22
5	T43	Craftsman	0.38 gal	Untreated	4/30 - 5/9	Pump	2.45
5	T44	Yard Machine	0.25 gal	Untreated	4/30 - 5/9	Pump	4.25
						Average	**3.29**

Attachment 2

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T4FE	652.14	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	4345.04	4345.08	-0.04	-0.03
1-May	4345.08	4345.03	0.05	0.04
2-May	4345.03	4345.00	0.03	0.02
3-May	4345.00	4345.01	-0.01	-0.01
4-May	4345.01	4344.97	0.04	0.03
5-May	4344.97	4345.01	-0.04	-0.03
6-May	4345.01	4345.08	-0.07	-0.05
7-May	4345.08	4345.01	0.07	0.05
	Std. Dev. Weight Loss Last Five Days	0.06	Avg. Permeation Last Five Days	0.00

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T5FE	1149.84	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	5842.80	5842.86	-0.06	-0.04
1-May	5842.86	5842.81	0.05	0.03
2-May	5842.81	5842.73	0.08	0.05
3-May	5842.73	5842.69	0.04	0.02
4-May	5842.69	5842.68	0.01	0.01
5-May	5842.68	5842.71	-0.03	-0.02
6-May	5842.71	5842.80	-0.09	-0.05
7-May	5842.80	5842.77	0.03	0.02
8-May	5842.77	5842.72	0.05	0.03
9-May	5842.72	5842.61	0.11	0.07
	Std. Dev. Weight Loss Last Five Days	0.08	Avg. Permeation Last Five Days	0.01

A**ttachment 2 Continued**

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T6E	1789.00	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	12147.4	12145.1	2.3	0.63
1-May	12145.1	12142.3	2.8	0.76
2-May	12142.3	12139.7	2.6	0.71
3-May	12139.7	12137.0	2.7	0.74
4-May	12137.0	12134.0	3.0	0.82
5-May	12134.0	12131.1	2.9	0.79
6-May	12131.1	12128.0	3.1	0.85
7-May	12128.0	12125.0	3.0	0.82
8-May	12125.0	12121.6	3.4	0.93
9-May	12121.6	12118.1	3.5	0.96
	Std. Dev. Weight Loss Last Five Days	0.26	Avg. Permeation Last Five Days	0.87

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T11F	2592.20	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	15297.1	15296.7	0.4	0.09
1-May	15296.7	15297.0	-0.3	-0.07
2-May	15297.0	15297.0	0.0	0.00
3-May	15297.0	15296.9	0.1	0.02
4-May	15296.9	15297.1	-0.2	-0.04
5-May	15297.1	15296.9	0.2	0.04
6-May	15296.9	15297.0	-0.1	-0.02
7-May	15297.0	15296.8	0.2	0.04
8-May	15296.8	15296.8	0.0	0.00
	Std. Dev. Weight Loss Last Five Days	0.18	Avg. Permeation Last Five Days	0.00

A**ttachment 2 Continued**

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T19	529.90	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	2004.07	2003.14	0.93	1.77
1-May	2003.14	2001.68	1.46	2.78
2-May	2001.68	2000.22	1.46	2.78
3-May	2000.22	1998.78	1.44	2.75
4-May	1998.78	1997.29	1.49	2.85
5-May	1997.29	1995.87	1.42	2.72
6-May	1995.87	1994.41	1.46	2.80
7-May	1994.41	1992.91	1.50	2.88
8-May	1992.91	1991.43	1.48	2.84
9-May	1991.43	1989.54	1.89	3.63
	Std. Dev. Weight Loss Last Five Days	0.19	Avg. Permeation Last Five Days	2.97

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T19E	521.50	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1894.63	1893.09	1.54	3.17
1-May	1893.09	1891.49	1.60	3.30
2-May	1891.49	1889.90	1.59	3.28
3-May	1889.90	1888.29	1.61	3.33
4-May	1888.29	1886.63	1.66	3.43
5-May	1886.63	1885.07	1.56	3.23
6-May	1885.07	1883.43	1.64	3.40
7-May	1883.43	1881.82	1.61	3.34
8-May	1881.82	1880.26	1.56	3.24
9-May	1880.26	1878.65	1.61	3.35
	Std. Dev. Weight Loss Last Five Days	0.04	Avg. Permeation Last Five Days	3.31

A**ttachment 2 Continued**

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T20	445.39	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1345.16	1344.16	1.00	3.12
1-May	1344.16	1343.20	0.96	3.00
2-May	1343.20	1342.19	1.01	3.16
3-May	1342.19	1341.19	1.00	3.13
4-May	1341.19	1340.14	1.05	3.29
5-May	1340.14	1339.14	1.00	3.14
6-May	1339.14	1338.15	0.99	3.11
7-May	1338.15	1337.08	1.07	3.36
8-May	1337.08	1336.03	1.05	3.31
9-May	1336.03	1334.98	1.05	3.31
	Std. Dev. Weight Loss Last Five Days	0.03	Avg. Permeation Last Five Days	3.25

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T24C	648.80	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1451.48	1449.82	1.66	5.85
1-May	1449.82	1448.16	1.66	5.86
2-May	1448.16	1446.45	1.71	6.05
3-May	1446.45	1444.77	1.68	5.96
4-May	1444.77	1443.08	1.69	6.00
5-May	1443.08	1441.44	1.64	5.84
6-May	1441.44	1439.70	1.74	6.21
7-May	1439.70	1438.06	1.64	5.86
8-May	1438.06	1436.44	1.62	5.80
9-May	1436.44	1434.86	1.58	5.67
	Std. Dev. Weight Loss Last Five Days	0.06	Avg. Permeation Last Five Days	5.88

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T24D	646.86	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1484.39	1482.73	1.66	5.61
1-May	1482.73	1481.06	1.67	5.65
2-May	1481.06	1479.28	1.78	6.03
3-May	1479.28	1477.63	1.65	5.61
4-May	1477.63	1475.93	1.70	5.79
5-May	1475.93	1474.28	1.65	5.63
6-May	1474.28	1472.56	1.72	5.88
7-May	1472.56	1470.86	1.70	5.82
8-May	1470.86	1469.16	1.70	5.83
9-May	1469.16	1467.60	1.56	5.37
	Std. Dev. Weight Loss Last Five Days	0.06	Avg. Permeation Last Five Days	5.71

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T29	276.75	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	875.75	875.08	0.67	3.14
1-May	875.08	874.41	0.67	3.14
2-May	874.41	873.70	0.71	3.33
3-May	873.70	873.00	0.70	3.29
4-May	873.00	872.29	0.71	3.34
5-May	872.29	871.62	0.67	3.16
6-May	871.62	870.93	0.69	3.26
7-May	870.93	870.19	0.74	3.50
8-May	870.19	869.45	0.74	3.50
9-May	869.45	868.71	0.74	3.50
	Std. Dev. Weight Loss Last Five Days	0.03	Avg. Permeation Last Five Days	3.38

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T30	278.01	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	983.78	983.15	0.63	2.51
1-May	983.15	982.49	0.66	2.63
2-May	982.49	981.81	0.68	2.71
3-May	981.81	981.12	0.69	2.75
4-May	981.12	980.45	0.67	2.67
5-May	980.45	979.83	0.62	2.48
6-May	979.83	979.17	0.66	2.64
7-May	979.17	978.46	0.71	2.84
8-May	978.46	977.74	0.72	2.89
9-May	977.74	977.03	0.71	2.85
	Std. Dev. Weight Loss Last Five Days	0.04	Avg. Permeation Last Five Days	2.74

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T31	277.55	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1042.98	1042.22	0.76	2.81
1-May	1042.22	1041.49	0.73	2.70
2-May	1041.49	1040.69	0.80	2.96
3-May	1040.69	1039.93	0.76	2.82
4-May	1039.93	1039.14	0.79	2.93
5-May	1039.14	1038.43	0.71	2.64
6-May	1038.43	1037.67	0.76	2.82
7-May	1037.67	1036.85	0.82	3.05
8-May	1036.85	1036.03	0.82	3.05
9-May	1036.03	1035.19	0.84	3.13
	Std. Dev. Weight Loss Last Five Days	0.05	Avg. Permeation Last Five Days	2.94

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T32	275.34	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	924.60	923.85	0.75	3.27
1-May	923.85	923.12	0.73	3.18
2-May	923.12	922.30	0.82	3.58
3-May	922.30	921.56	0.74	3.23
4-May	921.56	920.79	0.77	3.37
5-May	920.79	920.07	0.72	3.15
6-May	920.07	919.30	0.77	3.38
7-May	919.30	918.48	0.82	3.60
8-May	918.48	917.67	0.81	3.56
9-May	917.67	916.88	0.79	3.48
	Std. Dev. Weight Loss Last Five Days	0.04	Avg. Permeation Last Five Days	3.43

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T37	144.8	2838	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	339.33	339.01	0.32	4.67
1-May	339.01	338.66	0.35	5.11
2-May	338.66	338.30	0.36	5.27
3-May	338.30	337.97	0.33	4.84
4-May	337.97	337.62	0.35	5.14
5-May	337.62	337.30	0.32	4.71
6-May	337.30	336.97	0.33	4.87
7-May	336.97	336.60	0.37	5.46
8-May	336.60	336.24	0.36	5.33
9-May	336.24	335.89	0.35	5.19
	Std. Dev. Weight Loss Last Five Days	0.02	Avg. Permeation Last Five Days	5.11

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T38	153.17	2838	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	404.53	404.26	0.27	3.05
1-May	404.26	403.96	0.30	3.39
2-May	403.96	403.64	0.32	3.62
3-May	403.64	403.12	0.52	5.89
4-May	403.12	402.80	0.32	3.63
	Std. Dev. Weight Loss Last Five Days	0.10	Avg. Permeation Last Five Days	3.92

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T39	150.74	2838	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	317.41	317.08	0.33	5.62
1-May	317.08	316.74	0.34	5.80
2-May	316.74	316.37	0.37	6.33
3-May	316.37	316.06	0.31	5.31
4-May	316.06	315.72	0.34	5.84
5-May	315.72	315.41	0.31	5.33
6-May	315.41	315.10	0.31	5.34
7-May	315.10	314.75	0.35	6.04
	Std. Dev. Weight Loss Last Five Days	0.02	Avg. Permeation Last Five Days	5.57

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T40E	275.05	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	953.28	952.43	0.85	3.54
1-May	952.43	951.55	0.88	3.67
2-May	951.55	950.68	0.87	3.64
3-May	950.68	949.78	0.90	3.77
4-May	949.78	948.87	0.91	3.81
5-May	948.87	948.04	0.83	3.48
6-May	948.04	947.17	0.87	3.66
7-May	947.17	946.21	0.96	4.04
8-May	946.21	945.29	0.92	3.88
9-May	945.29	944.36	0.93	3.92
	Std. Dev. Weight Loss Last Five Days	0.05	Avg. Permeation Last Five Days	3.80

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T41E	423.42	2828	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1281.93	1280.62	1.31	4.32
1-May	1280.62	1279.32	1.30	4.29
2-May	1279.32	1277.98	1.34	4.43
3-May	1277.98	1276.62	1.36	4.50
4-May	1276.62	1275.36	1.26	4.18
5-May	1275.36	1274.05	1.31	4.35
6-May	1274.05	1272.77	1.28	4.26
7-May	1272.77	1271.49	1.28	4.26
8-May	1271.49	1270.22	1.27	4.23
9-May	1270.22	1268.93	1.29	4.31
	Std. Dev. Weight Loss Last Five Days	0.02	Avg. Permeation Last Five Days	4.28

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T42	438.1	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1138.38	1137.11	1.27	5.09
1-May	1137.11	1135.77	1.34	5.38
2-May	1135.77	1134.45	1.32	5.31
3-May	1134.45	1133.13	1.32	5.32
4-May	1133.13	1131.79	1.34	5.41
5-May	1131.79	1130.56	1.23	4.98
6-May	1130.56	1129.24	1.32	5.35
7-May	1129.24	1127.92	1.32	5.36
8-May	1127.92	1126.66	1.26	5.13
9-May	1126.66	1125.36	1.30	5.30
	Std. Dev. Weight Loss Last Five Days	0.04	Avg. Permeation Last Five Days	5.22

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T43	434.51	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1582.27	1581.33	0.94	2.30
1-May	1581.33	1580.39	0.94	2.30
2-May	1580.39	1579.41	0.98	2.40
3-May	1579.41	1578.41	1.00	2.45
4-May	1578.41	1577.41	1.00	2.45
5-May	1577.41	1576.48	0.93	2.28
6-May	1576.48	1575.48	1.00	2.46
7-May	1575.48	1574.45	1.03	2.53
8-May	1574.45	1573.46	0.99	2.44
9-May	1573.46	1572.43	1.03	2.54
	Std. Dev. Weight Loss Last Five Days	0.04	Avg. Permeation Last Five Days	2.45

Attachment 2 Continued

	Label	Tare Weight (grams)	Fuel Density (grams/gal)	
	Tank T44	430.53	2807	
Date	Initial Weight	Finial Weight	Weight Loss	Permeation (grams/gal/day)
30-Apr	1099.54	1098.52	1.02	4.28
1-May	1098.52	1097.52	1.00	4.20
2-May	1097.52	1096.46	1.06	4.46
3-May	1096.46	1095.43	1.03	4.34
4-May	1095.43	1094.40	1.03	4.35
5-May	1094.40	1093.41	0.99	4.19
6-May	1093.41	1092.41	1.00	4.23
7-May	1092.41	1091.43	0.98	4.16
8-May	1091.43	1090.36	1.07	4.54
9-May	1090.36	1089.39	0.97	4.13
	Std. Dev. Weight Loss Last Five Days	0.04	Avg. Permeation Last Five Days	4.25